Power Factor Correction Using Series Active Filter

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Abstract: As remembering the requirement we need more electricity to day-to-day life due to that it becomes needed to increase the growth of electrical power system. Consequently, increases losses and system becomes complex. To overcome these losses in power system and to improving the system performance using power electronic devices that causes increase in harmonics creation in system. Which are very harmful for the system Also, there is reduction in power factor which may be results in more losses in electrical power system. This implemented circuit helps to improve power factor by using active series filter.
Keywords: PFC, EMI, HVAC

Introduction

Now a days more number of variable speed motor drives supplied by single phase utility power are used in air conditioning (HVAC),ventilating and residential heating. In all these applications diode rectifier are using smoothing dc capacitors as the front end. The diode rectifier take pulsed current from the utility line , due to this low power factor, low efficiency and high rating requirements are needed to the switching devices. To reduce this drawbacks power factor correction is needed. So far to eliminate this drawbacks different types of active and passive PFC methods have been referred.

Active Filter

Below fig.1.shows the modern active series filter..Modern active series filter designed by using a combination of passive and active devices. As a switching device MOSFET are used for the frequent operation .MOSFET which are characterized by fast switching capability and insulated gate structure and can achieve resonance without the use of inductance. For rectification purpose voltage doubler circuit is used in voltage doubler circuit two capacitors are charged simultaneously over one cycle. The output voltage is doubled using voltage doubler circuit across dc link. Diode rectifier connected in series with full bridge inverter with an optional inductor as shown in fig.1.Therefore full bridge inverter and rectifier acts like voltage source. The line current is checked by the difference between these three voltage sources and the loop inductance ,which involves the line impedance Ls1 and Ls2 and the inductance of the optional inductor L. Also four switching devices are used in this method .Each device only needs to sustain a low capacitor voltage Vdc. For this purpose low cost high efficiency MOSFET can be employed. The total cost of the switching devices is still less than the cost of the traditional method.
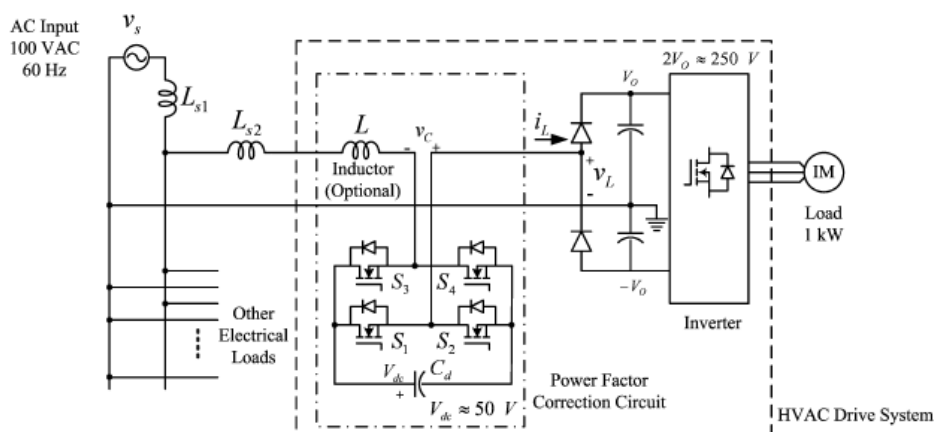

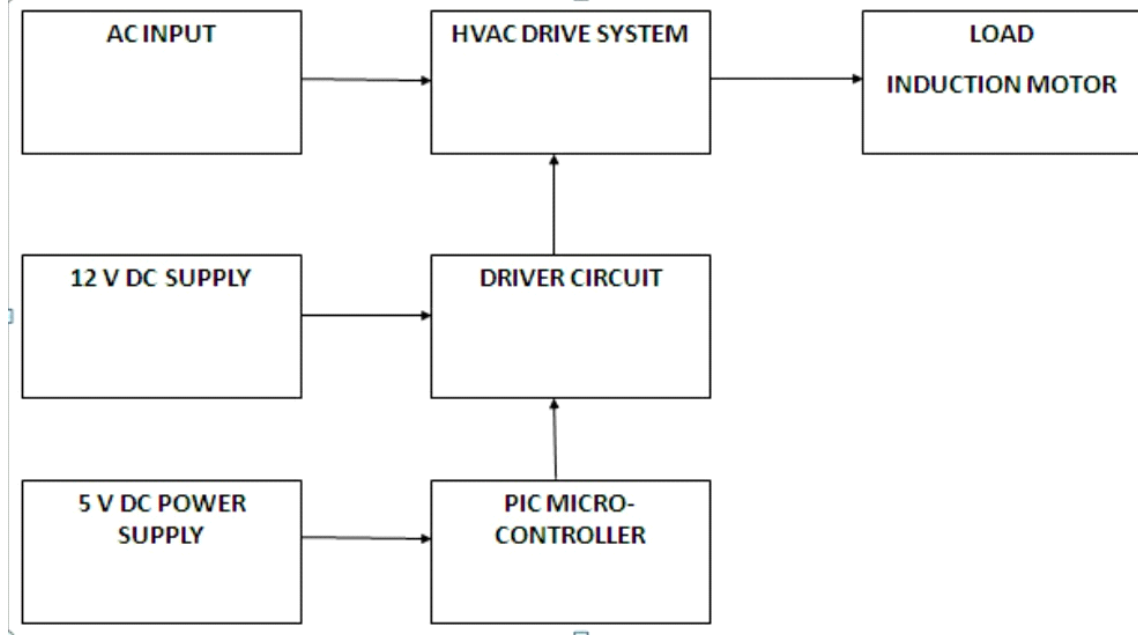Fig.1-Modern series active filter

Block Diagram

Fig.2 Block Diagram

1. POWER SOURCES- Electrical power supplies energy to the motor .Power sources can be of ac or dc in nature

2. AC supply-As HVAC system works on alternating current therefore input supply is taken.230V and is stepped down by using step down transformer.

3. DC supply-The single phase bridge rectifier is used to convert single phase ac to dc. Which further fed to power factor correction circuit where electronic switching devices are used and they require dc supply.

4. Driver circuit-Driver circuit is use to provide 5v to 12v to switch the MOSFET switch of the inverter. Also, it performs two function used for amplification and isolation purpose. So damage to the switching devices are prevented.

5. Induction Motor-Induction motor gets AC supply from inverter and it is used as load.

Advantages

- It helps to eliminate harmonics in the system.
- Lower cost due to rating of devices is low.
- Efficiency is high.

Conclusion

From this paper we conclude that our modern system is more superior than traditional system. Traditional PFC brings more switching losses and high EMI and also get high DC bus stress but in modern system we successfully overcome all this drawbacks and the system becomes more efficient and power factor is improved.

Acknowledgement

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